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SYSTEMIC ACTIVITY OF BIDRIN® IN LOBLOLLY PINE SEEDLINGS

Abstract. --Bioassay tests with pales weevils, Hylobius pales (Herbst), indicated that technical Bidrin® had a low degree of systemic activity when applied as a soil drench around 2-year-old, potted loblolly pine, Pinus taeda L., seedlings. The results of this experiment will probably preclude future testing of Bidrin® in the studies involving mechanisms of absorption and translocation of systemic insecticides being conducted at Research Triangle Park, North Carolina.

INTRODUCTION

Research aimed at studying the mechanisms of absorption and translocation of systemic insecticides by loblolly pine, Pinus taeda L., is underway at the Forestry Sciences Laboratory, Research Triangle Park, North Carolina. As part of this research, various organophosphorous insecticides are tested for their systemic activity by using forest insects as bioassay organisms. If an insecticide exhibits a high degree of systemic activity, it is used for further studies on absorption and translocation. The insecticides initially selected for screening were phorate, Di-Syston®, Monitor@, and Bidrin®.[1] The results of tests with phorate are described elsewhere (Werner and Clark 1969), and investigations with Di-Syston® and Monitor® are presently underway.

This paper describes the results obtained from an experiment on the systemic activity of Bidrin® and includes information on dosage rates and phytotoxicity. Bidrin® was selected because it has been reported to have systemic activity in various conifers: Sitka spruce, Picea sitchensis (Bong.) Carr. (Johnson 1965); Douglas-fir, Pseudotsuga menziesii (Mirb.) Franco (Johnson and Zingg 1967; Larson, Pieper, and Ratsch 1967); and red pine, Pinus resinosa Ait. (Walgenbach et al. 1964).

METHODS

This experiment was conducted in a greenhouse at a mean temperature of 70° F. (range 60" to 90" F.). Two- year-old loblolly pine seedlings were grown in individual pots of washed river sand, to which 50 ml. of a

[1] Mention of trade names or sources throughout this paper does not constitute endorsement by the U. S. Department of Agriculture to the exclusion of other equally acceptable products.

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standard nutrient solution (Sucoff 1961) was added once a week and 50 ml. of water twice a week. Treatments were by soil drench with 10 ml. of aqueous Bidrin® applied at concentrations of 0.05, 0.1, 0.5, 1 .0, 2.0, and 3.0 percent. All treatments were formulated from technical grade insecticide (9 lb. /gal.). The experiment comprised four test-groups of seedlings, each group consisting of two treated seedlings and one untreated seedling used as a control. Each group received the same treatment on the same day. Five days after treatment the seedlings were repotted in order to prevent a continuous uptake of the toxicant by the roots. This made the bioassay of the toxicant in the roots more precise since we could determine whether the toxicant remained in the roots or was transloeated upward into the stem and new growth.

Movement of the insecticide within the plant was assessed by bioassay of different parts of the seedlings fed to pales weevils, Hylobius pales (Herbst). Treated and untreated seedlings were dissected into roots, stems, and new terminal growth (shoots and needles), and five laboratory-reared weevils were placed with each group of plant tissue. Bioassays were made at intervals of 15, 30, 60, and 90 days after treatment; mortality of weevils was recorded after 48 hours.

RESULTS AND CONCLUSIONS

Tests following soil applications indicated that Bidrin® was absorbed by the roots of loblolly pine seedlings. The bioassays at 15 and 30 days after application of l-, 2-, and 3-percent treatments indicated high toxicity of Bidrin® to weevils feeding on the roots (table 1). At the same time, mortality of weevils feeding on stems and new growth was generally low. The high mortality of weevils feeding on the roots and the lower mortality of weevils feeding on upper portions of the seedling suggest that the roots retained a large portion of the toxicant. Since Bidrin® is highly water soluble and should readily move upward via the tree's water conduction system, it is possible that the chemical was diluted or rapidly degraded to nontoxic levels.

Adult weevils were killed when fed seedling stems and new growth 15 days after treatment with a 3-percent solution. (This was the only treatment which killed a significant number of weevils feeding on stems and new growth.)

The 3-percent solution of Bidrin® was the only concentration that killed weevils fed on roots, stems, and new growth and also caused a browning of the tips of old needles, indicating a slight phytotoxicity at this concentration. These data support the findings of Johnson and Zingg (1968) in which 4 and 6 ml. of a 0.5-percent concentration of Bidrin® were phytotoxic to the lower branches of Sitka spruce trees 4 to 6 inches in diameter. Johnson and Rediske (1965) also found that 5 ml. of a 0.5-percent concentration of Bidrin® was severely phytotoxic when injected into the branches of Douglas-fir trees.

Table 1. --Bioassay of Bidrin® in loblolly pine seedlings with pales weevil adults

Percentage concentration	Plant part	Insect mortality (days after treatment)			
		15	30	60	90
		Percent			
0.05	Roots	0	0	0	0
	Stem	a	10	0	0
	N. T. G.'	0	0	0	0
0.10	Roots	0	0	0	0
	Stem	10	10	0	0
	N. T. G.	0	0	0	0
0.50	Roots	20	0	0	0
	Stem	0	0	0	0
	N.T. G.	0	0	0	0
1.0	Roots	60	10	0	0
	stem	0	0	10	10
	N. T. G.	10	0	0	0
2.0	Roots	100	40	0	0
	stem	10	10	0	0
	N.T. G.	10	0	0	0
3.0	Roots	100	80	20	0
	stem	50	0	10	0
	N.T.G.	30	0	0	0
Control	Roots	0	0	0	0
	Stem	0	0	0	0
	N. T. G.	0	0	0	0

'N. T. G. = New Terminal Growth.

The poor movement (or rapid degradation) of Bidrin® in the water conduction system of pine seedlings and the short residual life of this insecticide indicate a low degree of systemic activity when applied as a soil drench. Based on these findings, there will probably be no future testing (in Research Triangle Park laboratories) of this insecticide using the soil drench method.

LITERATURE CITED

Johnson, N. E.
1965. A test of 12 insecticides for the control of the Sitka spruce weevil, Pissodes sitchensis Hopkins. J. Econ. Entomol. 58: 572-574.

and Rediske, J. H.
1965. A test of systemic insecticides to control Douglas-fir cone and seed insects. J. Econ. Entomol. 58: 1020-1021.

and Zingg, J. G.
1967. Effective translocation of four systemic insecticides following application to the foliage and cones of Douglas-fir. J. Econ. Entomol. 60: 575-578.

and Zingg, J. G.
1968. Field tests of systemic insecticides for the control of Sitka-spruce weevil. J. Econ. Entomol. 61: 1650-1652.

Larson, J. E., Pieper, G. R., and Ratsch, H. C.
1967. Systemic activity of Zectran, Matacil, and Bidrin injected into conifer trunks. Pesticides Monit. J. 1: 49-53.

Sucoff, E. J.
1961. Potassium, magnesium, and calcium deficiency symptoms of loblolly and Virginia pine seedlings. USDA Forest Serv. Northeast. Forest Exp. Sta. Pap. 164, 18 pp.

Walgenbach, D. D., Becker, C. C., Jr., Kearby, W. H., Benjamin, D. M., and Norris, D. M., Jr.
1964. The systemic insecticidal action of Shell OS-1836 and Bidrin on several insects associated with conifers. J. Econ. Entomol. 57: 764-765.

Werner, R. A., and Clark, E. W.
1969. Absorption, translocation, and distribution of phorate in loblolly pine seedlings. J. Econ. Entomol. 62: 436-437.

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